Early Human Development 101 (2016) 3–9

Contents lists available at ScienceDirect

Early Human Development

journal homepage: www.elsevier.com/locate/earlhumdev

Parenting very preterm infants and stress in Neonatal Intensive Care Units

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ARTICLE INFO

Article history:
Received 23 September 2015
Received in revised form 18 April 2016
Accepted 19 April 2016

Keywords:
Stress
Psychological
Parents
Infant
Premature
Intensive Care Units
Neonatal

ABSTRACT

Background: Assessing parental stress during infants' hospitalization in Neonatal Intensive Care Units (NICU) is essential to identify parents at risk for immediate and extended physical and emotional burden.
Aims: To identify sources of stress in mothers and fathers of very preterm infants hospitalized in NICU, and their association with sociodemographic, obstetric and infants' characteristics.
Study design: Observational and cross-sectional study conducted between July 2013 and June 2014.
Subjects: Parents of very preterm infants hospitalized in all level III NICU in the Northern Health Region of Portugal were consecutively and systematically invited to participate in this study, being included 120 mothers and 91 fathers (participation rate: 98.6%).
Outcome measures: The Portuguese version of the Parental Stressor Scale: Neonatal Intensive Care Unit was used.
Results: The overall experience of hospitalization was classified as more stressful than the median for the subscales. "Change in parental role" was classified as the most stressful subscale by mothers (Median (P25–P75): 4.1(3.2–4.7)) and fathers (Median (P25–P75): 3.2(2.4–4.0)). Mothers scored significantly higher in all subscales. For mothers, multiple pregnancy was associated with lower levels of stress regarding "change in parental role" ($\beta = -0.597$; 95% CI $= -1.020$ to -0.174) and "overall stress" ($\beta = -0.603$; 95% CI $= -1.052$ to -0.153). Being ≥30 years old was found to be a significant predictor for decreased fathers' stress.
Conclusions: This study raises awareness for the need to develop sensitive instruments that take notice of gender, social support and family-centered care. The implementation of interventions focused on reducing parental stress is crucial to diminish disparities in family health.

1. Introduction

The delivery of a very preterm infant, occurring at <32 gestational weeks [1], and his/her subsequent hospitalization in a Neonatal Intensive Care Unit (NICU), is often described as an emotional roller-coaster [2] and a stressful and disruptive life event for mothers and fathers [3]. Parenting a preterm infant' implies a continuous redefinition and adaptation of expected parental roles [4,5], while dealing with the loss of hope to give birth to a healthy neonate as well as of the "phantasy self-as-mother", an idealized state where no mistakes are ever made [6].

Throughout the hospitalization of very preterm infants in NICU, parents encounter multiple stressors that may interfere with the parent-infant relationship. First, the infant's medical condition and immaturity and his/her appearance, abnormal breathing and lower responsiveness to social interactions [4,7,8]. Second, the impediments to the development of interaction skills by both parents and the infant (e.g. the limited availability of the infant, parents' inability to focus on the infant's cues and to recognize his/her behaviors) that preclude changes in parental roles [9]. Third, the concern that the healthcare team may misunderstand the child's needs and the parents' feeling of lack of information on the diagnosis or treatment [8]. Fourth, the stressors related with the transition process to parenthood [2,10], alongside feelings of self-blame and guilt for putting the child through pain [11], which is

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http://dx.doi.org/10.1016/j.earlhumdev.2016.04.001
0378-3782/

particularly experienced by mothers [6,9]. Finally, the complexity of the NICU environment, with unknown specific smells and lights, noisy life support and monitoring equipment [4,7], lack of privacy [12] and the constant presence of healthcare professionals [13].

Several studies show that parental stress in NICU is influenced by a range of sociodemographic, obstetric and infant characteristics. These include parental age, ethnicity, socioeconomic status [14] and exposure to other stressful life events [15], as well as pregnancy planning and previous pregnancy loss, maternal trait anxiety and mental health history, severity of infant illness [2,10,16] and previous experience of infant's hospitalization in NICU [17]. However, the results of these studies are inconsistent. Moreover, most studies exclude fathers, offering a one-sided perspective that fails to approach the impact of NICU hospitalization on the parents and in the family. Furthermore, there are very few studies focusing on sources of stress among parents of very preterm infants and those that exist were mainly conducted in the United States of America [16].

Previous research also suggests that parents' experiences in NICU are associated with posttraumatic stress disorder beyond the period of hospitalization [2,13], with a very preterm birth influencing the family environment several years later. Studies report poorer family functioning and higher family burden 2 and 7 years after birth among preterm families when compared to families of term born infants [19]. Stressful family environments, stress experienced among couples and the potential long-term consequences of stress on parenting and child health over time may be exacerbated by the socioeconomic milieu [20]. Considering the association between social adversity across the life course and the development of non-communicable diseases [18,21], experiencing a very preterm delivery can have a longer impact on parents' health and well-being [18].

The assessment of sources of parental stress during infants' hospitalization in NICU and its associated factors is essential to identify parents at risk for immediate and extended physical and emotional burden. Knowledge about such stress sources and factors may help healthcare professionals to develop and implement measures and interventions aiming to provide benchmarks for quality improvement in NICU [13] and to promote family-centered care [22]. This study aims to help achieve these goals by identifying sources of stress in mothers and fathers of very preterm infants hospitalized in NICU, and their association with sociodemographic, obstetric and infant's characteristics.

2. Methods

This observational and cross-sectional study is based on a cohort of mothers and fathers of very preterm infants, which protocol has been previously described elsewhere [23]. The study was approved by the Portuguese Data Protection Authority and the Ethics Committees of all hospitals where the study was performed and written informed consent was obtained from all participants.

Briefly, all mothers and fathers of very preterm infants born between 1st July 2013 and 30th June 2014 and hospitalized in all level III NICU located in Northern Health Region of Portugal, 7 in total, were consecutively and systematically invited to participate in the study. Parents were approached during the hospital stay by a NICU health professional (neonatologist or nurse), who was responsible for the study presentation and invitation. A total of 201 very preterm infants were born, corresponding to 165 families (130 single pregnancies, 34 twin pregnancies and 1 triplet). After excluding families whose infants were not hospitalized in NICU at the time of the interview, due to discharge, transfer to another hospital or dead (n = 27), families with serious illness that precluded NICU visitation (e.g., severe chronic conditions) (n = 4), families who were not present in NICU during the baby's hospitalization period (n = 6), and those who did not read Portuguese (n = 2), 126 families were eligible to integrate the study. Among these, 122 (98.6%) accepted to participate. The study included 120 mothers and 91 fathers. Refusals were justified by lack of time to participate (n = 3) and psychological unavailability (n = 1). During data collection, 2 mothers were missed due to medical complications and 31 fathers were absent due to professional commitments or emigration.

Trained interviewers were responsible for conducting face-to-face interviews, 15 to 22 days after birth (Mean (SD) = 17.6 (2.3)), using structured questionnaires, to mothers and fathers, separately. Data on sociodemographic characteristics (gender, age, marital status, education and income), previous pregnancies and previous children (biological/adoptive vs. no children) were collected through self-report. Social support was assessed by the Multidimensional Scale of Perceived Social Support (MSPSS) [24] which measures the perceived adequacy of social support received from a significant other, from family and friends. Afterwards, mothers and fathers were asked to fill the validated Portuguese version of the Parental Stressor Scale: Neonatal Intensive Care Unit [25], a self-administered scale consisting of 26 items designed to measure parental perception of sources of stress arising from the environment of the NICU. Each item ranges from 1 (not at all stressful) to 5 (extremely stressful), being grouped into 3 dimensions: “Sights and Sounds” (6 items), “Baby Looks and Behaves” (13 items) and “Change in Parental Role” (7 items). Also, at the end of the questionnaire there is a question about “Overall stress”. The score of each of the abovementioned dimensions of the stress scale is calculated as the mean of the group of the respective individual items. It ranges from 1 to 5, with higher values indicating higher levels of parental stress.

Clinical records were reviewed by interviewers to retrieve data on pregnancy complications (which included infectious, placental, haemorrhagic and cardiovascular complications), multiple pregnancy (yes/no), and mode of delivery (vaginal or instrumental and caesarean). Data on the infant's sex, birth weight and gestational age were also collected. Extremely low birth weight and extremely premature infants were defined as birth weight bellow 1000 g [1] and gestational age under 28 weeks [1], respectively.

Statistical analysis was performed using Stata 11.0 (College Station, TX, 2009). Sample characteristics are presented as counts and proportions. The overall score of each subscale, stratified by gender, was presented as medians and percentiles (P25-P75) and compared using the Mann-Whitney test. Mean differences (β) in sources of stress and the respective 95% confidence intervals (95% CI) adjusted for age, educational level and all variables significantly associated with each subscale, were estimated by multiple linear regression models, stratified by gender.

3. Results

The characteristics of the study participants are summarized in Table 1. Almost 70% of the mothers and >75% of the fathers had 30 or more years of age. Most participants were married and this was the first pregnancy for >50% of them. <40% of the participants stated a household monthly income above 1500€, with approximately 40% of the mothers and 30% of the fathers reporting an educational level above 12 years. Pregnancy complications were described by >40% of mothers and fathers, caesarean was the most frequent mode of delivery and almost a quarter of pregnancies were multiple. Approximately 30% and 20% of pregnancies resulted in an extremely low birth weight delivery and in an extremely premature delivery, respectively.

Mothers of very preterm infants hospitalized in NICU classified the overall experience of hospitalization as very stressful (Median (P25–P75): 4.0 (3.0–5.0)), while fathers perceived such situation as stressful (Median (P25–P75): 3.0 (3.0–4.0)) (Table 2). Despite gender differences in the importance attributed to parental stressors, with mothers quoting significantly higher in all subscales, “change in parental role” was classified as the most stressful both by mothers (Median (P25–P75): 4.1 (3.2–4.7)) and fathers (Median (P25–P75): 3.2 (2.4–4.0)).

Tables 3 and 4 present mothers' and fathers' parental stressor subscales scores according to sociodemographic, obstetric and infants' characteristics, respectively. Women with multiple pregnancies reported

Table 1
Participants' characteristics, according to gender.

	Mothers (n = 120) n (%)	Fathers (n = 91) n (%)
Age (years)		
<30	38 (31.7)	22 (24.2)
≥30	82 (68.3)	69 (75.8)
Marital status		
Married/living with a partner	104 (86.8)	80 (87.9)
Single/divorced/widow	16 (13.3)	11 (12.1)
Education level (years)		
≤12	68 (56.7)	64 (70.3)
>12	52 (43.3)	27 (29.7)
Household income (€/month)		
≤1500	73 (62.4)	56 (61.5)
>1500	44 (37.6)	35 (38.5)
Gravidity		
1	63 (52.5)	54 (59.3)
>1	57 (47.5)	37 (40.7)
Previous children		
No	86 (71.7)	68 (74.7)
Yes	34 (28.3)	23 (25.3)
Pregnancy complications[a]		
No	70 (58.3)	51 (56.0)
Yes	50 (41.7)	40 (44.0)
Mode of delivery		
Vaginal/instrumental	38 (31.7)	27 (29.7)
Caesarean	82 (69.3)	64 (70.3)
Multiple pregnancy		
No	92 (76.7)	69 (75.8)
Yes	28 (23.3)	22 (24.2)
Extremely low birth weight delivery[b]		
No	83 (69.2)	65 (71.4)
Yes	37 (30.8)	26 (28.6)
Extremely preterm delivery[c]		
No	95 (79.2)	71 (78.0)
Yes	25 (20.8)	20 (22.0)

[a] Infectious, placental, haemorrhagic and cardiovascular complications.
[b] <1000 g.
[c] <28 gestational weeks.

lower levels of stress on "change in parental role" ($p = 0.023$) and "overall stress" ($p = 0.020$). Younger fathers (<30 years) presented higher levels of stress in all subscales and "overall stress". Fathers of an extremely preterm ($p = 0.013$) or an extremely low birth weight infant ($p = 0.002$) also revealed higher levels of "overall stress". The latter also attributed higher stress levels to "baby looks and behaves" ($p = 0.012$). Educational level, previous pregnancies, previous children, pregnancy complications, mode of delivery and extremely preterm delivery had no significant associations with parental stress.

After adjustment, multiple pregnancy remained associated with lower levels of stress regarding "change in parental role" and "overall stress" among mothers, while having 30 or more years of age was found to be a significant predictor for decreased fathers' stress related to all subscales and "overall stress" (Table 5).

Table 2
Parental Stressor Scale subscales scores, according to gender.

Parental Stressor Scale[a]	Mothers	Fathers	*p*
	Median (P25–P75)	Median (P25–P75)	
	n = 120	n = 91	
Sights and sounds	2.7 (2.2-3.4)	2.5 (1.8-3.0)	**0.004**
Baby looks and behaves	3.3 (2.5-4.2)	2.9 (2.2-3.6)	**0.002**
Change in parental role	4.1 (3.2-4.7)	3.2 (2.4-4.0)	**<0.001**
Overall stress	4.0 (3.0-5.0)	3.0 (3.0-4.0)	**0.004**

Bold figures represent significant differences between mothers and fathers, considering $p < 0.05$.
[a] Higher values indicate higher levels of parental stress (range for each subscale: 1–5).

4. Discussion

This study found that the perception of stress during hospitalization of a very preterm infant in NICU is higher among mothers than fathers. It also highlighted gender differences in the factors associated with the perception of stress: fathers' perception of stress was associated with age, while mothers' perceptions were related with multiple pregnancy. These findings contribute to a growing but still scarce literature addressing the specific factors associated with stress induced by the hospitalization of very preterm infants in NICU. This study also showed that, despite gender differences, "change in parental role" was the highest source of stress both for mothers and fathers, and the whole experience of hospitalization was classified as more stressful than the subscales "baby looks and behaves" and "sights and sounds".

"Change on parental role" was the subcale classified as the most stressful among mothers and fathers in our study. These results are corroborated by previous research conducted with parents of premature and term infants [4,13,14] and may be explained by parents' unability to assume their role as primary caregivers in NICU. This situation may lead them to feel less confident and incompetent in their parental roles due to physical and symbolic barriers that prevent them from touching and holding the child [8], and the feeling that they are unable to protect the child from harm [5], that may arise from a discrepancy between parents' social representation of their child and the real premature infant [6]. Our study also shows that the dimensions of "sights and sounds" and "baby looks and behaves" were less stressful for parents, when compared with "change in parental role". Throughout hospitalization, infant become more stable [26] and parents tend, simultaneously, to develop a mutually trustworthy relationship with health professionals, to feel more active in their child's care and more comfortable at NICU [12,27]. However, they continue to be prevented from performing traditional parental roles which might explain the strength of change in parental role as a predictor of stress among parents of infants hospitalized in NICU.

Gender is described as an important determinant of psychosocial stress and, as evidenced by our study, the literature has consistently showed that women tend to report higher levels of stress than men and to attribute more importance to stressful events [28]. Mothers of hospitalized infants, in particular, are more often exposed to daily stressful circumstances given their role as primary caregivers. They also spend more time in NICU and are more aware of caregiving activities [27,29]. Unlike mothers, who tend to focus mainly on the infant [30], fathers who adopt the traditional role of breadwinner, who is responsible for protecting the whole family [31], may be simultaneously concerned with the child, the mother and the work/external environment. This may have a protective effect regarding fathers' perception of stress. Mothers and fathers also cope differently with stressful conditions or events in NICU: fathers tend to delegate care to mothers, while leading the communication with healthcare professionals and focusing on work as a mechanism for distraction [29,32]; mothers use proximity and active participation in the infant's care as a coping mechanism [26,27,31,32]. Furthermore, cultural beliefs that endorse demonstrations of fearlessness and the appearance of being strong as a means of enacting masculinity [33] may contribute to explain why fathers in our study tended to perceive the experience of their infant's hospitalization as less stressful than mothers. Nevertheless, these findings should be interpreted with some caution. If we look at measures of physiological stress responses, no differences between women and men are observed when they are exposed to the same stressor [34]. This suggests that our results may not necessarily be indicating that fathers have lower perceived stress levels, but rather that measures aiming to assess self-reported stress are not sufficiently sensitive to pick up perceived stress among men in its entirety, perhaps due to the social complexities of gender. Further research on the degree of gender sensitivity of stress measures is needed.

Table 3
Mothers' Parental Stressor Subscales scores, according to sociodemographic, obstetric and infant's characteristics (n = 120).

	Parental Stressor Subscale[a]			
	Sights and sounds median (P25–P75)	Baby looks and behaves median (P25–P75)	Change in parental role median (P25–P75)	Overall stress median (P25–P75)
Age (years)				
<30	2.9 (2.3–3.3)	3.6 (2.9–4.2)	4.3 (3.3–4.8)	4.0 (3.0–5.0)
≥30	2.7 (2.2–3.4)	3.2 (2.5–4.2)	4.0 (3.2–4.6)	4.0 (3.0–5.0)
P	0.601	0.276	0.252	0.748
Marital status				
Married/living with a partner	2.8 (2.2–3.4)	3.3 (2.6–4.1)	4.0 (3.2–4.7)	4.0 (3.0–5.0)
Single/divorced/widow	2.6 (2.2–3.8)	3.5 (2.4–4.5)	4.4 (3.5–4.7)	4.0 (3.0–4.0)
P	0.343	0.597	0.347	0.301
Education level (years)				
≤12	2.7 (2.3–3.3)	3.4 (2.7–4.1)	4.1 (3.3–4.7)	4.0 (3.0–4.0)
>12	2.8 (2.2–3.6)	3.3 (2.4–4.2)	4.0 (3.2–4.6)	4.0 (3.0–5.0)
p	0.599	0.881	0.495	0.116
Household income (€/month)				
≤1500	2.7 (2.3–3.3)	3.4 (2.8–4.1)	4.1 (3.4–4.6)	4.0 (3.0–4.0)
>1500	2.8 (2.3–3.6)	3.4 (2.6–4.3)	4.1 (3.2–4.7)	4.0 (3.0–5.0)
p	0.312	0.915	0.746	0.430
Gravidity				
1	2.8 (2.3–3.5)	3.3 (2.7–4.1)	4.1 (3.4–4.7)	4.0 (3.0–5.0)
>1	2.7 (2.2–3.3)	3.3 (2.5–4.3)	4.0 (3.2–4.7)	4.0 (3.0–4.0)
p	0.404	0.971	0.582	0.318
Previous children				
No	2.8 (2.2–3.5)	3.3 (2.5–4.2)	4.1 (3.3–4.7)	4.0 (3.0–5.0)
Yes	2.7 (2.2–3.3)	3.4 (2.5–4.2)	4.0 (3.1–4.7)	4.0 (3.0–5.0)
p	0.352	0.664	0.912	0.919
Pregnancy complications[b]				
No	2.8 (2.3–3.5)	3.4 (2.6–4.2)	4.1 (3.3–4.7)	4.0 (3.0–4.0)
Yes	2.7 (2.2–3.3)	3.3 (2.5–4.2)	4.0 (3.2–4.7)	4.0 (3.0–5.0)
p	0.203	0.563	0.804	0.596
Mode of delivery				
Vaginal/instrumental	2.8 (2.2–3.3)	3.3 (2.5–4.0)	4.2 (3.4–4.7)	4.0 (3.0–4.0)
Caesarean	2.7 (2.2–3.4)	3.4 (2.5–4.2)	4.0 (3.1–4.7)	4.0 (3.0–5.0)
p	0.625	0.693	0.361	0.623
Multiple pregnancy				
No	2.8 (2.3–3.4)	3.3 (2.8–4.2)	4.1 (3.5–4.7)	4.0 (3.0–5.0)
Yes	2.7 (2.2–3.4)	3.4 (2.3–4.2)	3.5 (2.7–4.5)	3.0 (2.0–4.0)
p	0.469	0.491	**0.023**	**0.020**
Extremely low birth weight delivery[c]				
No	2.8 (2.2–3.4)	3.3 (2.5–4.1)	4.0 (3.1–4.6)	4.0 (3.0–4.0)
Yes	2.7 (2.2–3.3)	3.8 (2.9–4.4)	4.3 (3.4–4.9)	4.0 (3.0–5.0)
p	0.831	0.173	0.115	0.102
Extremely preterm delivery[d]				
No	2.7 (2.2–3.3)	3.3 (2.5–4.2)	4.0 (3.1–4.7)	4.0 (3.0–4.0)
Yes	3.3 (2.3–3.8)	3.8 (3.2–4.4)	4.3 (3.4–4.8)	4.0 (3.5–5.0)
p	0.166	0.088	0.157	0.125

Bold figures represent significant differences considering $p < 0.05$.
[a] Higher values indicate higher levels of parental stress (range for each subscale: 1–5).
[b] Infectious, placental, haemorrhagic and cardiovascular complications.
[c] <1000 g.
[d] <28 gestational week.

The differences between the factors associated with parents' perception of stress in NICU identified by this study offer a good opportunity to discuss multiple femininities and masculinities. Studies assessing the perception of stress by mothers of infants admitted to NICU show contradictory results. While some found increased stress levels among older [35,36], unmarried, low-income and less-educated mothers, independently of the infants' gestational age [17], others demonstrated that younger mothers, married and more educated reported higher stress levels [4]. In contrast, our study found no significant associations between mothers' stress levels and variables such as age, marital status, income or level of education. However, our results show that a multiple pregnancy is a significant predictor for decreased mothers' stress levels in NICU. As observed in a recent study, mothers with multiple pregnancies tend to feel overburden during pregnancy, given increased medical involvement and physical discomfort, and also to expect neonatal risks, including preterm birth [37]. These mothers may have been better prepared throughout their pregnancy for complications in the neonatal period and therefore for handling the stress of the NICU. Additionally, the stress of the pregnancy, labour and birth experienced by mothers with multiple babies may be so acute that they perceive the stress in the aftermath of a preterm delivery as being relatively easier to cope with.

Our study also shows that age is a significant predictor for decreased fathers' stress levels in NICU: having 30 or more years of age is a protective factor. Although the literature about fathers' perceived stress is scarce, one study notes that older fathers may experience lower levels of stress because they benefit from a broader lack of previous life experiences that are helpful in preparing them for assuming parental roles and responsibilities [38]. However, we could expect mothers to experience a similar process. Perhaps younger men experience additional fears concerning the wellbeing of their partner and infant and the future of their family because they tend to have less security at work and are therefore less likely to resort to their working environment to buffer stress as older men might do.

No significant differences were observed in the experience of stress by socioeconomic factors (education or income) in men and women. This may be linked to the acuteness of a NICU experience where families

Table 4
Fathers' Parental Stressor Subscales scores, according to sociodemographic, obstetric and infant's characteristics (n = 91).

	Parental Stressor Subscale[a]			
	Sights and sounds median (P25–P75)	Baby looks and behaves median (P25–P75)	Change in parental role median (P25–P75)	Overall stress median (P25–P75)
Age (years)				
<30	2.8 (2.5–3.2)	3.6 (3.2–4.2)	3.7 (3.3–4.3)	4.0 (3.0–5.0)
≥30	2.2 (1.7–3.0)	2.7 (2.1–3.3)	3.0 (2.4–3.7)	3.0 (2.0–4.0)
p	**0.014**	**<0.001**	**0.002**	**0.002**
Marital status				
Married/living with a partner	2.5 (1.8–3.2)	3.0 (2.3–3.5)	3.2 (2.5–3.9)	3.0 (3.0–4.0)
Single/divorced/widow	2.2 (1.8–2.6)	2.6 (2.2–3.7)	3.4 (2.1–4.7)	3.0 (2.0–4.0)
p	0.344	0.597	0.347	0.301
Education level (years)				
≤12	2.5 (1.8–3.1)	3.0 (2.3–3.6)	3.4 (2.4–4.0)	3.0 (2.0–4.0)
>12	2.5 (1.8–2.8)	2.8 (2.1–3.3)	3.0 (2.5–3.6)	3.0 (3.0–4.0)
p	0.600	0.343	0.193	0.774
Household income (€/month)				
≤1500	2.5 (1.8–3.2)	2.9 (2.2–3.6)	3.3 (2.4–4.0)	3.0 (2.0–-4.0)
>1500	2.5 (1.8–3.0)	3.1 (2.3–3.5)	3.1 (2.6–3.9)	3.0 (3.0–4.0)
p	0.316	0.915	0.746	0.430
Gravidity				
1	2.4 (1.8–3.0)	2.8 (2.1–3.4)	3.3 (2.5–4.0)	3.0 (3.0–4.0)
>1	2.5 (1.7–3.2)	3.1 (2.5–4.0)	3.0 (2.4–3.9)	3.0 (3.0–4.0)
p	0.585	0.108	0.862	0.849
Previous children				
No	2.5 (1.8–3.0)	2.9 (2.2–3.5)	3.3 (2.5–4.0)	3.0 (3.0–4.0)
Yes	2.5 (1.7–3.4)	3.1 (2.4–4.2)	3.0 (2.4–3.9)	3.0 (3.0–4.0)
p	0.938	0.281	0.583	0.538
Pregnancy complicationsa				
No	2.6 (1.8–3.0)	3.0 (2.4–3.5)	3.3 (2.5–4.0)	3.0 (3.0–4.0)
Yes	2.4 (1.7–3.1)	2.9 (2.1–3.7)	3.0 (2.4–3.9)	3.0 (2.0–4.0)
p	0.496	0.767	0.440	0.322
Mode of delivery				
Vaginal/instrumental	2.5 (1.8–3.0)	2.9 (2.1–3.4)	3.1 (2.4–3.7)	4.0 (3.0–4.0)
Caesarean	2.5 (1.8–3.2)	2.9 (2.2–3.7)	3.2 (2.5–4.0)	4.0 (3.0–4.0)
p	0.767	0.404	0.478	0.857
Multiple pregnancy				
No	2.5 (1.8–3.0)	2.9 (2.3–3.6)	3.0 (2.5–4.0)	3.0 (3.0–4.0)
Yes	2.4 (1.7–3.2)	2.9 (2.0–3.5)	3.4 (2.4–3.9)	3.0 (2.0–4.0)
p	0.959	0.562	0.860	0.059
Extremely low birth weight deliveryb				
No	2.5 (1.8–2.8)	2.7 (2.1–3.4)	3.2 (2.4–3.9)	3.0 (2.0–4.0)
Yes	2.8 (1.8–3.2)	3.4 (3.0–3.8)	3.1 (2.7–4.0)	4.0 (3.0–5.0)
p	0.262	**0.012**	0.547	**0.002**
Extremely preterm deliveryc				
No	2.3 (1.8–2.8)	2.8 (2.1–3.5)	3.3 (2.4–4.0)	3.0 (2.0–4.0)
Yes	2.9 (1.7–3.3)	3.4 (2.5–4.1)	3.0 (2.8–3.8)	4.0 (3.0–5.0)
p	0.240	0.073	0.916	**0.013**

Bold figures represent significant differences considering $p < 0.05$.
[a] Infectious, placental, haemorrhagic and cardiovascular complications.
[b] <1000 g.
[c] <28 gestational weeks.
[a] Higher values indicate higher levels of parental stress (range for each subscale: 1–5).

Table 5
Adjusted mean difference (β) of the mothers' and fathers' Parental Stressor Scale scores, according to sociodemographic, obstetric and infant's characteristics.

	Sights and sounds	Baby looks and behaves	Change in parental role	Overall stress
	Adjusted β (95% CI)[a]	Adjusted β (95% CI)[a]	Adjusted β (95% CI)[a]	Adjusted β (95% CI)[a]
Mothers				
Age, years (≥30 vs. <30)	−0.120 (−0.438 to 0.198)	−0.188 (−0.593 to 0.216)	−0.120 (−0.509 to 0.269)	0.001 (−0.413 to 0.414)
Education level, years (≤12 vs >12)	0.116 (−0.183 to 0.414)	0.006 (−0.374 to 0.385)	−0.083 (−0.449 to 0.283)	0.327 (−0.063 to 0.717)
Multiple pregnancy (Yes vs. No)	–	–	**−0.597 (−1.020 to −0.174)**	**−0.603 (−1.052 to −0.153)**
Fathers				
Age, years (≥30 vs. <30)	**−0.510 (−0.919 to −0.101)**	**−0.794 (−1.238 to −0.351)**	**−0.670 (−1.099 to −0.240)**	**−0.756 (−1.290 to −0.222)**
Education level (≤12 vs >12)	−0.408 (−0.183 to 0.359)	−0.205 (−0.612 to 0.203)	−0.240 (−0.642 to 0.162)	0.014 (−0.467 to 0.495)
Extremely low birth weight delivery (Yes vs. No)	–	0.358 (−0.060 to 0.775)	–	0.537 (−0.003 to 1.077)
Extremely preterm delivery (Yes vs. No)	–	–	–	0.440 (−0.130 to 1.010)

95% CI, 95% confidence interval; β, mean differences.
Bold figures represent significant differences, taking into account the interpretation of the 95%CI that should not include the value zero to be statistically significant.
[a] Adjusted for age and educational level and all statistically significant variables for each subscale.

tend to find themselves in the same situation, independently of their social backgrounds. However, once the child returns home, this experience of stress may become differentiated based on factors such as socioeconomic position or social support [39]. A future longitudinal follow-up study is necessary to elucidate this question.

Methodologically, this study offers two major contributions. First, it includes fathers in the research. This is a key methodological advantage both because it enabled the identification of gender differences in the perception of stress and an examination of the factors associated with these differences. Another major contribution relates to the comparison of stress levels between mothers and fathers of very preterm infants and their association with sociodemographic, obstetric and infant's characteristics in a representative sample: data collection was carried out over an extended recruitment period of one year and participants were consecutively and systematically invited to participate in all level III NICU from the North of Portugal. Despite the innovative nature of the present study, some limitations should be discussed. First, the exploratory results require replication. It is also important to highlight the need to compare the perception of stress among parents of very preterm infants with the perceptions of parents with non-very preterm infants hospitalized in NICU. Additionally, further studies comparing stress scores according to regimes of family-centered care and parental feelings of self-blame and guilt related to birthing a preterm infant are needed. Furthermore, it is crucial to identify potential stressors beyond the NICU environment, including stressful family environments and stress experienced within couples.

One final consideration regards the stress scores identified by our study: when compared to most previous studies about stress among parents of preterm infants and term infants with low birth weight hospitalized in NICU, our study found higher scores on the stress subscales for both mothers and fathers [10,17]. However, it is important to highlight that the studies available report mean scores, and not median scores, which hinders the direct comparison with our results.

Lack of social support did not explain this tendency in the present study, since participants reported high levels of support received from a significant other, family and/or friends and, as a result, it was not significantly associated with parental stress (data not shown). These differences may thus be explained by methodological issues, namely unrepresentative sampling and the moment of data collection, which in some studies took part during the second week of hospitalization [10]. They may also be due to societal issues. Wide differences exist between (and sometimes within) countries in terms of political frameworks on parental leave, regimes of family-centered care, stigmatization and social prejudices associated with prematurity and parental feelings of self-blame and guilt [6] related to birthing a preterm infant. Less favorable environments and circumstances, as it appears to have been the case with the parents included in our study [40] such as absence of parental leave equal to the period of hospitalization for both parents, as well as the lack of privacy in the NICU, are likely to be conducive to more stressful experiences with infant hospitalization. If such high levels of stress were to persist over time and become an integral part of the parenting style and family functioning, major problems related to chronic stress may arise [19].

To conclude, our findings confirm that becoming a parent of a very preterm infant and his/her subsequent hospitalization in NICU is an event associated with emotional distress. Assessing parental sources of stress is essential to promoting parental support and guidance, and to increasing parents' awareness of the key role they can play in the early stages of their child's development. Our findings indicate that it might be advisable for healthcare staff to pay particular attention to younger fathers. This study also points out the need to deliver follow-up care to parents to help them cope with stress, and to consider other factors that may be positively associated with parental stress during hospitalization in NICU, namely lack of social and governmental support, financial and work concerns, stigmatization and social prejudices, and limited attention to family-centered care. Attending to these factors and implementing interventions focused on reducing parental stress is crucial to diminish disparities in family health across and within countries.

Finally, considering that parenting a very preterm infant during hospitalization in NICU will most likely be a stressful event, it is necessary to assess its potential damage in the long-term and to explore how it may affect family functioning and wellbeing.

Acknowledgments

We thank all mothers and fathers, and the health professionals for their collaboration in the study.

This study is based upon work supported by FEDER funding from the Operational Programme Factors of Competitiveness - COMPETE and by national funding from the FCT - Foundation for Science and Technology (Portuguese Ministry of Education and Science) within the project "Parenting roles and knowledge in neonatal intensive care units" (FCOMP-01-0124-FEDER-019902) and the grants IF/00956/2013 (to SS), SFRH/BPD/103562/2014 (to EA), and PD/BD/105830/2014 (to MA).

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